Unbundled Elements, Special Access, and Impairment for Wireline and Wireless Services

George S. Ford, *President, Applied Economic Studies, Tampa, FL 33635, gford@aestudies.com*.

Michael D. Pelcovits, *Principal, MiCRA, Washington, DC 20036, mp@micradc.com*.

In the Triennial Review Order, the Federal Communications Commission ("FCC") concluded that the ability of competitive local exchange carriers ("CLECs") to purchase high-capacity loop and transport services from the incumbent local exchange carriers ("ILECs") at retail prices (i.e., Special Access services) was irrelevant in the impairment analysis regarding access to high-capacity facilities as unbundled network elements ("UNEs") at cost-based prices (i.e., TELRIC).[1] In its *USTA II* decision, the D.C. Circuit Court of Appeals stated that the Commission failed to provide sufficient justification for excluding from the impairment analysis retail alternatives provided by the ILECs.[2] A key point raised by the Court was that competition thrives in the wireless telecommunications industry despite that industry's reliance on Special Access rather than UNEs for its transport needs. Thus, the court concluded that the Commission cannot summarily disregard the availability of ILEC retail services in the agency's impairment determinations, and must provide a more reasoned basis for its decision.

The purpose of this paper is to provide an analytical framework for evaluating when retail alternatives provided by the ILEC are relevant to an impairment determination. We do so using standard economic tools and, for clarity, do so in the context of the wireless analogy provided by the court. Our choice in this regard by no means limits our analysis to this particular example; our framework is sufficiently general to cover a wide range of applications. Further, our approach is neither exclusive nor exhaustive – other analytical tools may very well be relevant to this issue.[3]

---

[1] *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers,* REPORT AND ORDER AND ORDER ON REMAND AND FURTHER NOTICE OF PROPOSED RULEMAKING, CC Docket No. 01-338 (August 21, 2003) at ¶ 576 ("Triennial Review Order").

[2] *United States Telecom Association v. FCC*, 359 F.3rd 554, 569 (D.C. Cir. 2004).

[3] For example, it is certainly feasible for competition to flourish in industry A even though it purchases an input from industry B at monopoly prices, although the equilibrium price will be higher in A than if the input from B was purchased at the competitive price. It is an entirely different situation when entrants must pay the incumbent monopolist in B whatever price the monopoly sees fit to charge (which, by definition, is a price that no entrant would be willing to pay). Also, the dominance of the ILEC in wireline telecommunications leads to powerful incentives to block competitive entry, much more so than in the wireless industry, because the probability the circuit will

This paper begins by describing a basic economic tool useful for evaluating the court's discussion on the relevance of retail alternatives provided by the ILEC to the impairment analysis. We then apply the tool in relation to high-capacity circuits, which can be purchased as UNEs or Special Access services. Key to our analysis is the assumption that impairment, as defined in Section 251(d)(2)(B) of the 1996 Telecom Act, exists when a lack of access to an unbundled element substantially reduces a firm's ability to provide service; that is, the firm provides less output without the element than with it, and the difference is material and non-transitory. This definition of impairment is consistent with nearly every detailed definition proposed.[4] Thus, the relevant question on this issue, it seems to us, relates to how price differences between a UNE and retail services affects the output of firms.

I. Methodology

Our methodology begins with the assumption that demand curves slope downward, and this relationship holds for both end-user and input (or derived) demands. Second, and somewhat related to the first, we assume that the quantity of goods and/or services sold by a firm is inversely related to the incremental cost of production – as incremental costs rise, output declines.[5] Neither of these assumptions is controversial, or at least neither should be. In fact, the FCC refers the inverse relationship between price and quantity as a "universal economic truism."[6] We also assume constant returns to scale, constant elasticities, and fixed proportions.

---

be used to serve an existing ILEC customer is very high in wireline communications. *See* T. Beard, G. Ford, and L. Spiwak, *Why ADCo? Why Now? An Economic Exploration into the Future Industry Structure for the "Last Mile" in Local Telecommunications Markets*, 54 FEDERAL COMMUNICATIONS LAW JOURNAL: 421-459 (2002) (an earlier version appeared as PHOENIX CENTER POLICY PAPER NO. 12, November 2001: www.phoenix-center.org).

[4] *See* T. R. Beard, R. B. Ekelund Jr., and G. S. Ford, *The Law and Economics of Unbundling and Impairment*, 2003 JOURNAL OF LAW, TECHNOLOGY & POLICY 475-501 (2003) ("the failure to provide access to such network elements would [reduce] the [output] in time *t* of the telecommunications carrier [*i*] seeking access [in market *g* by *m* percent]. Also see *Mayo/MiCRA/Bates White Economic Impairment Analysis* (October 4, 2004) at 28 ("Requesting carriers are impaired in their ability to provide the services they seek to offer if the consequence of failure to provide the requested network element poses a barrier or barriers to entry, including operational and economic barriers, and where the effect may be substantially to lessen competition, or to tend to create a monopoly in the provision of the retail services that utilize the requested element.").

[5] On the relationship of marginal cost and price, *see* J. Tirole, THE THEORY OF INDUSTRIAL ORGANIZATION (1995) at 66-7. In cases where a cost increase affects only some firms in an industry, production is shifted from the high-cost to the low-cost firms. However, under plausible conditions, the transfer of output is incomplete, since the increased cost of some firms in the industry causes price to rise so that total industry output declines.

[6] *Triennial Review Order*, *supra* n. 1, at ¶ 576.

The fact that a firm's output is inversely related to input prices is interesting, but the more relevant issue for policy making is the magnitude of the relationship. Will output be affected a little or a lot if input prices rise? Given our assumptions, the percentage change in the quantity demanded of input i with respect to a percentage change in the price of input i (p_i) is

$$\varepsilon_{ii} = s_i \eta \tag{1}$$

where ε_{ii} is the own-price elasticity of input demand for input i, s_i is the share of input i in incremental cost, and η is the own-price elasticity of demand for the firm's output (i.e., the firm's residual demand).[7] Equation (1) simply states that a firm's output response to an input price change increases as the input's share of total incremental cost rises and as the firm's residual demand elasticity becomes more elastic (i.e., more negative).[8] With fixed proportions, which we have assumed, the percentage reduction in the quantity demanded of the input is equal to the percentage reduction in the output of the firm (i.e., the output effect), since one input is required for each unit of output. So, with two pieces of information (s_i and η), we can determine the effect on a firm's output of an input price change.

If the relationship between the input and output is variable rather than fixed proportions, then Equation (1) will understate the demand elasticity for the input (i.e., the actual elasticity will be more negative than ε_{ii} in Eq. 1). Also, with variable proportions, the change in output is no longer equal to the change in the quantity of the input, since the firm moves to relatively cheaper inputs as the price of one input rises. Thus, in the case of variable proportions, the implied output effect from Equation (1) will be too large, and the magnitude of this overstatement will depend on the ability to effectively substitute inputs.[9] For example, if there is a perfect substitute for the input in question, then the output effect will be zero, despite the fact that the input elasticity is very large (i.e., infinite in this case).

From this very simple Equation (1), much can be said about the effects of higher prices for high-capacity circuits across a variety of market segments that use these facilities. As mentioned above, our attention is focused on the use of high-capacity loops and transport by competitive wireline carriers and the wireless industry. In the following two sections, we attempt to arrive at reasonable estimates of the input

---

[7] *See* P. R. G. Layard and A. A. Walters, MICROECONOMIC THEORY (1978) at 262-3. The price elasticity of demand for input x with respect to its price p is $(\Delta x/\Delta p)(p/x)$.

[8] Importantly, the demand elasticity in Eq. (1) is not the market demand elasticity, but the firm's residual demand elasticity. The firm-specific demand elasticities are typically large in competitive markets, and always larger than the market elasticity of demand.

[9] This relationship is called the "elasticity of substitution." Layard and Walters, *supra* n. 7, at Ch. 9.

and associated output elasticities for the two industries, which will inform us as to the importance of high-capacity circuit prices on firms and, eventually, end users.

1. HIGH CAPACITY LOOP AND TRANSPORT PRICES AND COMPETITIVE LOCAL EXCHANGE CARRIERS

Wireline telecommunications service provided to medium and large business customers requires that a dedicated high-capacity circuit connect the customer's premise to the customer's local exchange provider. Therefore, loops (and to a somewhat lesser extent transport) and telecommunications service are provided in fixed proportions. Typically, the dedicated loop plus transport represents a sizeable portion of the incremental cost of production.

To our knowledge, there are no econometric estimates of the demand elasticities for high-capacity UNE circuits. There are, however, studies that estimate the own-price demand elasticities for other types of subscriber loops and Special Access circuits. These elasticities are computed for the input itself and in cases where the facilities are used in fixed proportions; the estimated elasticity corresponds to ε in Equation 1. While Special Access circuits may be used in fixed proportions, such services also can be used in variable proportions. Thus, the estimated elasticities for Special Access circuits may not be ideal estimates of ε in Equation (1).

In a recently published study, Beard, Ekelund and Ford (2004) estimate the demand elasticity for loops combined with CLEC-supplied switching (or UNE-Loop). The estimated elasticity for UNE loops combined with self-supplied switching is -1.1, indicating a 10% increase in the loop price reduces output by 11%.[10] Unbundled loops and UNE-Loop service is a fixed proportions technology, so the estimated elasticity in this study also measures the output effect from loop price changes. Two recent studies employ econometric techniques to estimate the demand elasticities for Special Access circuits, which may be employed in either fixed or variable technologies. Ford and Spiwak (2003) estimate the own-price demand elasticity for DS-0 Special Access circuits to be –1.5, and Rappaport and Taylor (2003) estimate elasticities for DS-1 and DS-3 Special Access circuits to be -1.3 and –1.9, respectively.[11] Generally, the own-price demand elasticities for the high-capacity circuits are found to be in the ballpark of -1.0, so we presume that a valid estimate of the elasticity for high-capacity UNE circuits would be reasonably close to –1.0.

---

[10] Beard, Ekelund, and Ford, *supra* n. 4.

[11] G. S. Ford and L. J. Spiwak, *Set It and Forget It? Market Power and the Consequences of Premature Deregulation in Telecommunications Markets*, PHOENIX CENTER POLICY PAPER NO. 18 (July 2003) (available at www.phoenix-center.org) and P. N. Rappoport, L. D. Taylor et al., *Macroeconomic Benefits from a Reduction in Special Access Prices* (2003) (available at: http://www.comptel.org/press/sparc_june12_2003_study.pdf).

These studies all estimate the demand elasticity of the input directly. An alternative approach to estimating the elasticity of an input is to acquire estimates of s_i and η and compute the elasticity using Equation 1. Using a simple econometric model and the inverse elasticity pricing rule, we estimate that for CLEC's selling services combining high-capacity UNE loops and transport with their own facilities and resources have a residual demand elasticity (η) of about –2.25, on average (implying a 44% price-cost margin).[12] We assume, then, that the representative CLEC has a residual demand elasticity of -2.25.

To estimate the high-capacity loop's share of total incremental costs (s_i), we begin by assuming the retail price for DS-1 based telecommunications services is $1000 per month.[13] Using the elasticity estimate and this retail price, the implied incremental cost for the service is $560.[14] On average, the price of a DS-1 UNE circuit is about $200 per month.[15] Thus, the DS-1 loop represents about 36% of total incremental cost (=200/550). Using equation (1), we can compute the elasticity for DS-1 circuits, which is calculated to be –0.8 (-2.25 · 0.36). Thus, a 10% increase in the price of a UNE DS-1 circuit will reduce CLEC purchases of DS-1 circuits by 8.0% and, since a circuit is required to provide wireline service, CLEC output declines by the same 8.0%. The estimated DS-1 circuit elasticity seems reasonable given the estimated elasticities for other types of circuits and Special Access circuits discussed above (with elasticities slightly more elastic than unitary).

2. HIGH CAPACITY CIRCUIT PRICES AND WIRELESS CARRIERS

Estimating the input elasticity for high-capacity facilities in the wireless industry is assisted by recent analyses conducted as part of the Cingular/AT&T Wireless merger. Beard, et al (2004) employed an econometric model to estimate the residual

---

[12] The elasticity is based on regression analysis including data for six CLECs (2001-2003 data) that purchase high capacity UNE circuits (XO, US LEC, ITC Deltacom, Choice One, McLeod USA, and Pac-West). The linear regression model regresses revenues on operating costs, and the elasticity is backed out using the coefficient on operating cost and the inverse elasticity pricing rule. We assume that revenues and operating costs are quantity-scaled measures of prices and incremental costs, and that a firm's own-price elasticity is constant and independent of its rivals' prices. The estimated elasticity is -2.25 (implying a gross profit margin of 44%). As for the econometric model, the (robust) t-statistic on cost is about 12.3, the R-squared is 0.93, and the linear model is found to be appropriate (based on the Ramsey RESET test). The results are similar for the first-differences version of the model. The implied margins of 44% seem reasonable for telecommunications services involving high fixed costs.

[13] Price is based on a survey of prices for DS-1 services as presented in *Mayo et al, supra* n. 4, at 57.

[14] The incremental cost is chosen so that the margin is 45% [=(1000 – 550)/1000].

[15] *Mayo et al., supra* n. 4. The $200 figure includes the loop and the transport elements of the high-capacity circuit (e.g., an enhanced extended link or EEL).

elasticities for wireless firms, and this statistical analysis indicates that wireless firms face residual demand elasticities of about –2.2, on average.[16] Richard Gilbert, testifying on behalf of Cingular and AT&T Wireless, provides evidence indicating that Special Access services account for about 3.3% of a wireless carrier's costs of goods sold.[17] Since Special Access prices paid by wireless carriers are probably about 100% higher than UNE prices, if the wireless carriers were using UNE rather than Special Access circuits, the cost share would be 1.7%, other things constant.[18]

Using these values and Equation (1), the computed elasticity for high capacity loops for wireless carriers is –0.037, which is very inelastic. In the wireless industry, the quantity demanded for such facilities is not very sensitive to price; for a 10% increase in the loop price, purchases (and output) falls by only 0.37%. The responsiveness to price is roughly twenty-two times larger in the wireline (0.8) than in the wireless industry (0.037). Given the similar residual demand elasticities (2.25 versus 2.2), the difference in the input elasticities is primarily the result of the sizeable difference in the cost share of high capacity facilities across the two industries. In our particular example, and probably in many others, the cost share alone may be sufficient to differentiate situations for which the availability of retail services is relevant to an impairment analysis.

It is worth observing that the validity of the fixed proportions assumption is weaker in the wireless industry than in the wireline industry. High-capacity circuits in the wireless industry do not connect end-users to carrier facilities; they are used to connect cell towers, so the facilities are shared among many users. While it is certainly not true that each wireless customer requires exactly one high-capacity loop, it may be reasonable to conclude that each customer requires some fixed share of a high capacity loop (ignoring, to some extent, the lumpiness of capacity). The fact that in the wireless industry the high-capacity facility is not connecting individual customers to the network, but is carrying large amounts of traffic

---

[16] T. Beard, M. Pelcovits, and R. Saba, *A Simulation Analysis of the Effects on Mobile and Wireline Prices of the Cingular-AT&T Wireless Merger*, filed by Comptel/Ascent in WT Docket No. 04-70 (October 1, 2004) at Table 1 (we compute a share-weighted average): http://www.comptelascent.org/public-policy/federal-regulatory/documents/2004/att_cingular_merger_oct1_2004.pdf.

[17] *Supplemental Declaration of Richard J. Gilbert filed on Behalf of Cingular and AT&T Wireless*, WT Docket No. 04-70 (May 13, 2004) and AT&T Wireless S.E.C. Form 10-K (Year 2003). The share of costs is based on AT&T Wireless' Special Access expenditures divided by its operating costs less depreciation and sales, general, and administrative costs.

[18] Wireless carriers use Special Access, which on average has a price about 100% higher than UNE high-capacity circuits under long-term commitments. See Mayo et al, *supra* n. 4, at 57 and *Reply Declaration of M. Pelcovits and C. Frentrup* , WC Docket No. 0-313 (October 19. 2004) at Table II.

between towers, also suggests that an entry response to a large price increase is more likely since the circuit is connecting to points of aggregated traffic.[19]

The implication of variable rather than fixed proportions in the wireless industry implies that the input elasticity we estimate under the assumption of fixed proportions is too small (that is, quantity is more sensitive to price than Eq. 1 indicates). However, it is also the case the input elasticity overstates the output effect, since with variable proportions substitute inputs can be used to avoid the higher priced input. We are interested primarily in the output effect, so the assumption of fixed proportions is conservative, and we retain it for that reason.[20] Our estimated output effect, however, will be overstated and we acknowledge that fact and caveat our results accordingly.

II. The Output Effect and High Capacity Circuit Prices

Is it possible for the wireline carriers to be impaired and the wireless carriers not to be impaired without access to high-capacity UNE circuits at cost-based prices? We propose to answer this important policy question with the input elasticities derived in the previous section.

As a starting point, we need to know the percentage price difference between purchasing a high-capacity circuit as a UNE and as Special Access service. Across the nation, the typical price paid for a high-capacity DS-1 circuit is about $200.[21] On a month-to-month basis, that same circuit would be priced at about $550 if purchased as a Special Access service.[22] Thus, the percentage difference between UNE and Special Access prices is about 175%. This price increase is very large, so we caveat our conclusions by observing that the point elasticity estimates derived above may not be valid for such a large price increase. We do note, however, that demand curves typically become more elastic at higher prices, so our estimates of the output effects from this price change are conservative.

We also caveat our findings by acknowledging that in the case of the wireless industry we will overstate the output effect for (at least) three reasons: 1) the assumption of fixed proportions for wireless carriers may not be realistic; 2) the

---

[19] Aggregation raises the market size per dollar of sunk costs thereby allowing more firms in equilibrium. *See* J. Sutton, SUNK COSTS AND MARKET STRUCTURE (1996); T. R. Beard and G. S. Ford, *Competition in Local and Long-distance Telecommunications Markets*, THE INTERNATIONAL HANDBOOK OF TELECOMMUNICATIONS ECONOMICS, ed. by G. Madden (2002); and Beard, Ford, and Spiwak, *supra* n. 3

[20] To consider the variable proportions case we would need estimates of the elasticity of substitution between high-capacity circuits and other inputs, which we do not have.

[21] *Mayo et al, supra* n. 4, at 57.

[22] *Id*.

elasticities may be understated for such a large price increase; and 3) unlike CLECs serving end-users with high-capacity circuits, the wireless industry can purchase Special Access circuits under long-term commitments at sizeable discounts.[23] Given the inherent uncertainties related to end-user churn and other factors, CLECs cannot benefit from the reduced rates from long-term commitments.

Under the assumption of fixed proportions, the output effects can be computed by multiplying the input elasticities by 175%, the price difference between UNE and Special Access services. For CLECs in the wireline industry, a 175% increase in the price of high-capacity circuits will reduce CLEC output by 141% (indicating the exit of CLECs from the market).[24] In contrast, that same price increase would only reduce output in the wireless industry by 6.5%, and for the reasons discussed above, this 6.5% decline in output is probably a substantial overstatement of the output effect. For example, if Special Access is purchased under a long-term commitment resulting in a 30% discount, the output effect is reduced to only 3.4%.[25]

This comparative analysis based on standard economic analysis reveals that a movement to Special Access from UNE prices for high-capacity circuits will harm wireline CLECs much more than wireless carriers, and we estimate that differential to be very large (exceeding a factor of twenty). For the wireless sector, the difference between UNE and Special Access pricing results in no more than a 6.5% reduction in output. Some might view this reduction in output to be sufficiently

---

[23] A review of Special Access tariffs indicates that three and five-year commitments typically result in about a 30% discount off the month-to-month price. Other conditions on the purchase may produce even larger discounts. See *Pelcovits/Frentrup Reply*, supra n. 18 at Table II. When considering the relevance of retail services in an impairment analysis, it is important to consider whether or not current retail prices are reliable indicators of retail prices when UNEs are no longer available. Since the opportunity cost of selling to a rival or potential is higher than the opportunity costs of selling to a non-rival, the retail price for non-rival carriers will not be an accurate indicator of the retail price for rivals if UNEs are eliminated. *See* Beard, Ford and Spiwak, *supra* n. 3. Furthermore, UNEs and Special Access are substitutes, so the availability of UNEs imposes some price constraint on Special Access services. Eliminating UNEs is akin to the exit of a chief competitor, and the expectation of eliminating high-capacity UNEs is higher prices for Special Access services. Time Warner Telecom observes that the Bell Companies raised prices for Special Access services immediately following the *USTA II* decision, a decision that threatens to eliminate the availability of unbundled high-capacity circuits. See *Comments of Time Warner Communications*, WC Docket No. 04-313 (October 4, 2004) ("After the release of the *USTA II* decision, SBC's proposed terms became significantly more onerous and discriminatory. [ ] Similarly, since the release of the *USTA II* decision, Qwest has increased significantly the month-to-month charges in its federal special access tariff. For example, Qwest increased its DS1 channel termination rate in the densest "zone 1" by 24.75 percent and its 0-8 mile DS1 transport mileage charge by 36.48 percent (at 16-7).").

[24] A similar conclusion was reached by an alternate analysis in M. Bryant and M. Pelcovits, *The Economic Impact of the Elimination of DS-1 Loops and Transport as Unbundled Network Elements* (June 29, 2004).

[25] Even if the CLECs were to get a similar discount, the output reduction for the CLECs is 74%.

small to determine wireless carriers are not impaired with respect to high-capacity circuits (others may disagree). Alternately, the same price increase for high-capacity circuits applied to wireline carriers cuts their output by 141%; it is impossible to describe such a reduction in output as immaterial. Clearly, a lack of access to cost-based high-capacity circuits substantially impairs a CLEC's ability to provide service, and we conclude from this analysis that it is appropriate to ignore the availability of Special Access services from the impairment analysis for high-capacity circuits used by wireline carriers to provide end-user services.

III. Conclusion

If it is to have any meaning, impairment must reflect the ability of a firm to provide service, and that ability is sensibly captured in the realization or expectation of a firm's output. If the purchase of higher price retail alternatives rather than UNEs has little effect on output, then it may be sensible to include these alternatives in an impairment determination. However, if output is strongly affected by input price changes, then the retail services are not properly included in the impairment analysis.

We have presented a simple analytical framework, drawn from standard economic theory, for determining when retail price alternatives are relevant to an impairment determination. Our analysis focuses on the influence of input price changes on a firm's output, which is plainly a reasonable approach to the issue. We conclude that the relevance of retail price alternatives varies inversely with a) the input's share of total incremental costs; b) the firm's residual demand elasticity; and c) the differential between retail and cost-based prices. Our approach is analytically rigorous, and reasonable estimates of each of these factors are easily obtained.